

Serial No. **10/812,905**

Docket No. **LT-0056**

Reply to Office Action dated January 29, 2007

### **REMARKS**

Claims 1-23 are pending in this application. By this Amendment, claims 2, 4, 7-8 and 19-20 are amended and claims 23-58 are canceled without prejudice or disclaimer. The amendments are made for clarity (and are unrelated to issues of patentability).

The Office Action rejects claims 1-4, 7-11 and 14-23 under 35 U.S.C. §102(e) by U.S. Patent Publication No. 2004/0140967 to Kojo. The Office Action also rejects claims 5, 6, 12 and 13 under 35 U.S.C. §103(a) over Kojo.

Kojo has a U.S. filing date of November 5, 2003. In contrast, the present application claims priority from four Korean Patent Applications each having a filing date prior to Kojo's filing date. Applicants are attaching a verified English-language translation of each of the four Korean priority documents. The priority documents support each of the rejected claims. Thus, the rejections based on Kojo should be withdrawn.

### **CONCLUSION**

In view of the foregoing, it is respectfully submitted that the application is in condition for allowance. Favorable consideration and prompt allowance of claims 1-23 are earnestly solicited. If the Examiner believes that any additional changes would place the application in better condition for allowance, the Examiner is invited to contact the undersigned attorney at the telephone number listed below.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this,

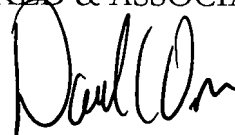
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concurrent and future replies, including extension of time fees, to Deposit Account 16-0607 and please credit any excess fees to such deposit account.

Respectfully submitted,  
KED & ASSOCIATES, LLP



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Attachments: Four Verified English-language  
translations of Korean Priority Documents

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**Date: May 29, 2007**

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**Please direct all correspondence to Customer Number 34610**



## DECLARATION

I, Lae Bong PARK, Patent Attorney, hereby declare the following:

I am knowledgeable in Korean and English. I have reviewed Korean Patent Application Nos. 10-2003-0061549, 10-2003-0055520, 10-2003-0063107 and 10-2003-0061548 and believe the attached documents to be an accurate translations thereof.

All statements made herein of my own knowledge are true and all statements made on information and belief are believed to be true. Further, these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

A handwritten signature in black ink, appearing to be "Lae Bong PARK", written over a horizontal line.

Date & Signature: Lae Bong PARK

## ABSTRACT

### Summary

The present invention relates to a method and device for controlling the keyboard of a convertible computer, which prevent the keyboard of a convertible computer, which can be used both for a tablet computer and for a notebook computer, from operating erroneously. The method and device for controlling the keyboard of a convertible computer is characterized in that, when the convertible computer, having both a notebook computer function and a tablet computer function, is used for a tablet computer, erroneous operation caused by a keyboard pressing phenomenon is prevented. For this purpose, in the present invention, a microcontroller, which is a keyboard controller, is assigned one pin for monitoring system mode, and performs control so that the keyboard enters an activated state or an inactivated state based on a signal input to the pin. The present invention can prevent the erroneous operation of the keyboard, which is caused due to the use of a notebook computer mode and a tablet computer mode, through such control. Furthermore, the present invention can prevent the keyboard from operating erroneously in a circuit manner without constructing a separate and supplementary mechanical device, so that the burden of additional cost can be avoided.

### Key Figure

FIG. 5

### Key Words

notebook, tablet, mode, keyboard

## SPECIFICATION

### Title

#### METHOD AND DEVICE FOR CONTROLLING KEYBOARD OF CONVERTIBLE COMPUTER

5

### Brief Description Of The Drawings

FIG. 1 is a block diagram showing the control structure of the keyboard of a conventional notebook computer;

10 FIGS. 2a and 2b are perspective views of a convertible computer according to the present invention;

FIG. 3 is a block diagram showing the control structure of the keyboard of the convertible computer according to the present invention;

15 FIG. 4 is a diagram showing the operational states of the keyboard of the convertible computer according to the present invention; and

FIG. 5 is a flowchart illustrating the control of the keyboard of the convertible computer according to the  
20 present invention.

### Major Elements In Drawings

11: keyboard

13: microcontroller

10: main body

30: display unit

25

### Background Of The Invention

The present invention relates to a method and device for controlling the keyboard of a convertible computer and, more particularly, to a method and device for controlling  
30 the keyboard of a convertible computer, which prevent the keyboard of a convertible computer, which can be used both for a tablet computer and for a notebook computer, from

operating erroneously.

A tablet computer is a device that has been devised to combine the advantages of a desktop computer, a notebook  
5 computer and a handheld device. That is, the notebook computer, although it is a mobile computer, can be used only when the main body thereof is fixed on a support surface, whereas the tablet computer has excellent mobility and convenience because it can be used while being held in  
10 the hand, like a Personal Digital Assistant (PDA), and enables data to be directly written on the monitor thereof using an electronic pen, instead of a keyboard. Furthermore, the tablet computer has a simple outward appearance because it is provided with all of the basic  
15 components of a computer behind the monitor thereof. In addition, the tablet computer is convenient to use because it is not necessary to use a separate input device, such as a mouse, because a touch screen is used.

The notebook computer and the tablet computer have  
20 different purposes and uses as described above, and thus they have created different markets and have been independently implemented and used with different specifications. Accordingly, in the case where the notebook computer and the tablet computer are implemented  
25 together in a single system, a management method is required for their usage modes.

Meanwhile, the keyboard of a conventional computer used for a notebook computer, as shown in FIG. 1, is constructed in the same manner as the keyboard of a typical  
30 desktop computer. That is, keyboard cables are configured between a keyboard 1 and a microcontroller 3, which is a keyboard controller, so that various signals can be transmitted. In the keyboard of the computer, having the

above-described construction, there is no problem caused by the use of the system and the open and closed states of a display unit.

However, in the case where the computer is used for a tablet computer, the display unit must rotate in the state in which the computer is used for a notebook computer and be superimposed on a main body, and a liquid crystal part must be configured to be the upper portion of the computer, which is used for a tablet computer. Accordingly, there is a phenomenon in which the keyboard of the main body is pressed by the rear of the display unit. As a result, when the computer is used for a tablet computer, a problem occurs in that the erroneous operation of a system is caused by the keyboard pressing phenomenon.

15

#### **Explanation Of The Invention**

Accordingly, it is an object of the present invention to provide a method and device for controlling the keyboard of a convertible computer, which prevent the keyboard of a convertible computer, which is implemented both as a tablet computer and as a notebook computer, from being erroneously operated.

In order to achieve the above object, the present invention provides a device for controlling the keyboard of a convertible computer, the device having both a notebook computer function and a tablet computer function, the keyboard control device including a mode change monitoring means for monitoring the change of system mode; and a control means for performing control so that the operational state of the keyboard becomes an activated state or an inactivated state according to a current system mode.

In addition, the present invention provides a method

of controlling the keyboard of a convertible computer, the device having both a notebook computer function and a tablet computer function, the method including a mode change monitoring step of monitoring the change of system mode; and a control step of performing control so that the operational state of the keyboard becomes an activated state or an inactivated state according to a current system mode.

10       The method and device for controlling the keyboard of a convertible computer according to the present invention are described in detail with reference to the accompanying drawings below.

FIGS. 2a and 2b are perspective views of a convertible computer according to the present invention.

The convertible computer of the present invention is used for a tablet computer when a display unit 30 rotates and the front of the display unit 30 is oriented upwards, as shown in FIG. 2b. Furthermore, the convertible computer is used for a notebook computer when the display unit 30 is erected and is oriented toward the front, as shown in FIG. 2a.

Accordingly, the display unit 30 is oriented toward the front in the state shown in FIG. 2a, that is, in a notebook computer mode, so that input can be made using the keyboard 20. In a tablet computer mode, the display unit 30 is rotated about a rotational axis (not shown) as indicated by the dotted lines of FIG. 2a. In this case, the rear of the display unit 30 is rested on a main body 10, so that the display unit 30 is in a state in which the front thereof is oriented upwards when the electronic device is placed on a support surface. In this state, input can be made though the display unit 30 using a stylus



pen.

Meanwhile, when the mode is switched from the notebook computer mode to the tablet computer mode, or is switched from the tablet computer mode to the notebook mode, the convertible computer is used through the rotation of the display unit 30. When the above-described operation is performed, a contact switch operates between the display unit 30 and the main body 10, and thus the switching of the system mode is monitored.

10 FIG. 3 is a block diagram showing a construction for mode control in the convertible computer according to the present invention.

The convertible computer of the present invention is configured such that the contact switch operates when the switching of the system mode is performed. The operation of the contact switch is performed such that a signal is input to a microcontroller 13, which is a keyboard controller. In this case, the input signal is BTN\_TBLMODE#. That is, in the present invention, the microcontroller 13 is assigned one pin in order to monitor the system mode.

20 Accordingly, the microcontroller 13 detects the switching state of the system mode based on the contact switch operation signal. The contact switch operation signal, input to the microcontroller 13, as shown in FIG. 4, is configured such that a high level signal is input in the notebook computer mode but a low level signal is input in the tablet computer mode. In the notebook computer mode, the microcontroller 13 performs control so that the keyboard enters an activated state and then performs controls corresponding to signals input through the keyboard. In the tablet computer mode, the microcontroller 13 performs control so that the keyboard enters an inactivated state and then ignores the signals input

through the keyboard.

Furthermore, the microcontroller 13, which is the keyboard controller of the present invention, is connected with the keyboard 11 through keyboard cables KEY0 to KEY13  
5 and KEYCROW0 to KEYCROW7.

The operational process of a method of controlling the keyboard of the convertible computer according to the present invention is described below.

FIG. 5 is a flowchart illustrating the control of the  
10 keyboard of the convertible computer according to the present invention.

When power is supplied to the system, the microcontroller 13 always monitors the operational state of the keyboard 11 connected thereto via the keyboard cables  
15 11. Furthermore, when a user selects an arbitrary key, a key signal corresponding to the selected key is input, which signal is selected is detected, and control necessary for the detection is performed. Accordingly, when an arbitrary key of the keyboard 11 is selected and pressed,  
20 regardless of the situation, the microcontroller 13 performs control so that the task corresponding to the selected key is performed.

However, the above-described operation is validated only when the convertible computer is used in the notebook  
25 computer mode. Accordingly, in the present invention, the microcontroller 13 detects a current system mode, and performs control so that a necessary keyboard task is performed according to the detected mode.

For this purpose, the microcontroller 13 always  
30 monitors the contact switch operation signal 'BTN\_TBLMODE#.' Furthermore, the microcontroller 13 detects the current system mode based on the signal at step 500.

If it is determined that the current system mode is a notebook computer mode at step 510, a high level signal is input as the contact switch operation signal 'BTN\_TBLMODE#' for the microcontroller 13 at step 520. In this case, the  
5 microcontroller 13 performs control so that signal lines connected to the keyboard 11 enter an activated state, and thus normal control associated with the key selection operation of the keyboard 11 is performed at step 530.

In contrast, if it is determined that the system mode  
10 is a tablet computer mode, a low level signal is input as the the contact switch operation signal 'BTN\_TBLMODE#' for the microcontroller 13 at step 550. In this case, the microcontroller 13 performs control so that signal lines connected to the keyboard 11 enter an inactivated state.  
15 Accordingly, when the signal lines of the keyboard 11 enter an inactivated state, the microcontroller 13 ignores signals input through the keyboard 11, even in the case where arbitrary keys of the keyboard 11 are pressed, at step 550.

20 As described above, the method of controlling the keyboard of a convertible computer according to the present invention is characterized in that, when the convertible computer, having both a notebook computer function and a tablet computer function, is used for a tablet computer,  
25 erroneous operation due to the keyboard pressing phenomenon can be prevented. For this purpose, in the present invention, the microcontroller, which is a keyboard controller, is assigned one pin, which is used to monitor the system mode, and performs control so that signals input  
30 through the keyboard enter an activated state or an inactivated state based on a signal input through the pin.

From the above-described description, those skilled in the art will appreciate that various variations and

modifications are possible within a range that does not depart from the technical spirit of the present invention. Accordingly, the technical scope of the present invention is not limited to the detailed description in the specification, but should be defined solely by the following claims.

#### **Effect Of The Invention**

As described above, the method and device for controlling the keyboard of a convertible computer according to the present invention can prevent the erroneous operation of the keyboard, which is caused due to the use of a notebook computer mode and a tablet computer mode. Furthermore, the present invention can prevent the keyboard from operating erroneously in a circuit manner without constructing a separate and supplementary mechanical device, so that the burden of additional cost can be avoided.

#### **What is claimed is:**

1. A device for controlling a keyboard of a convertible computer, the device having both a notebook computer function and a tablet computer function, the keyboard control device comprising:

mode change monitoring means for monitoring a change of system mode; and

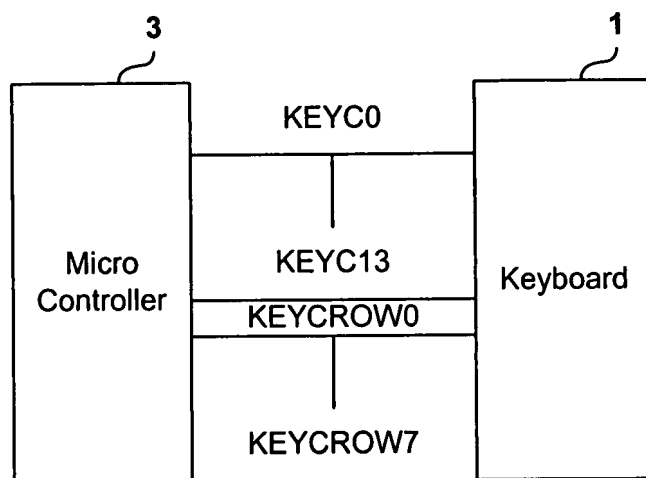
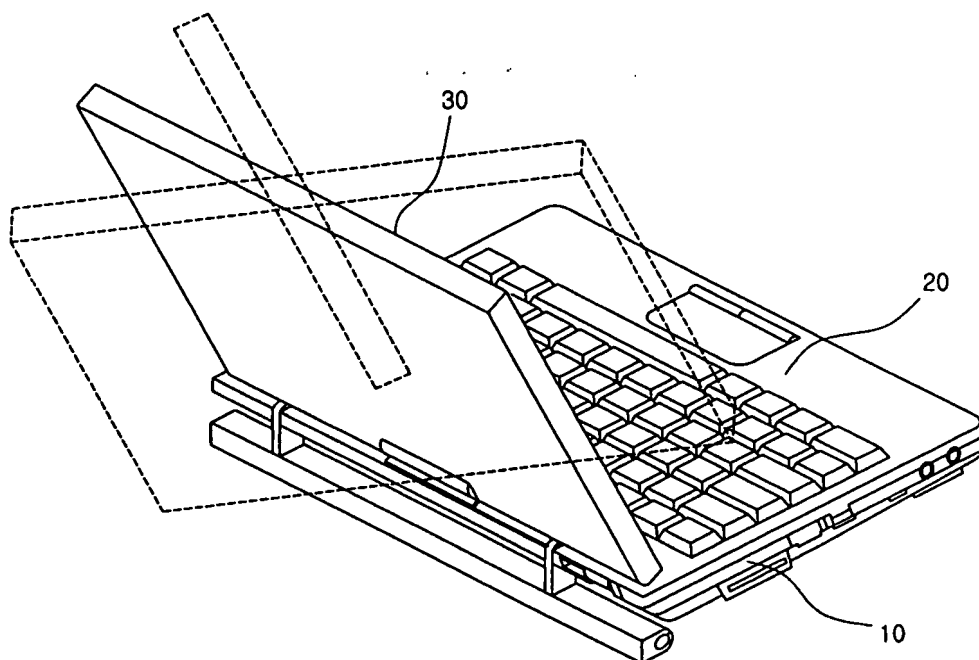
control means for performing control so that an operational state of the keyboard becomes an activated state or an inactivated state according to a current system mode.

2. A method of controlling a keyboard of a

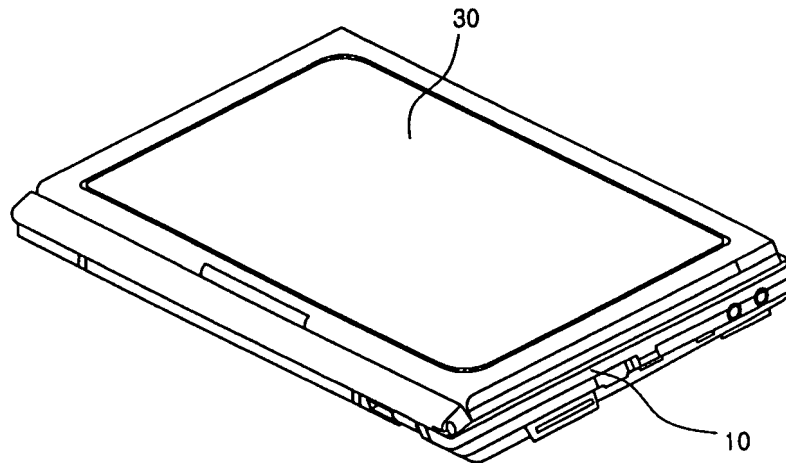
convertible computer, the device having both a notebook computer function and a tablet computer function, the method comprising:

5 a mode change monitoring step of monitoring a change of system mode; and

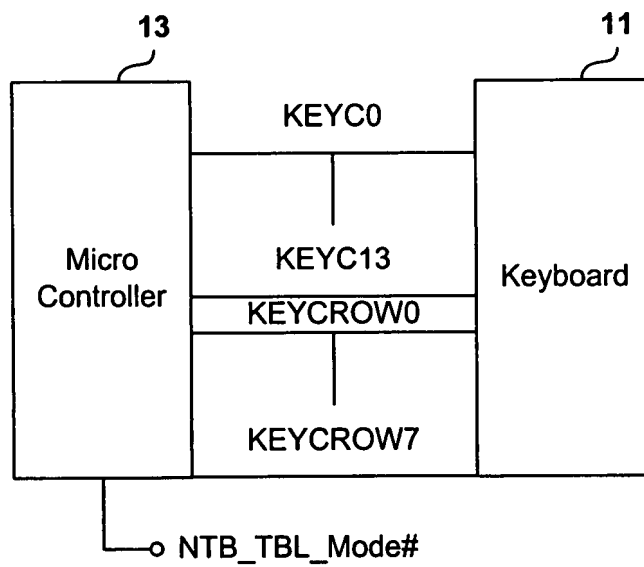
a control step of performing control so that an operational state of the keyboard becomes an activated state or an inactivated state according to a current system mode.

**FIG. 1****FIG. 2A**

**FIG. 2B**

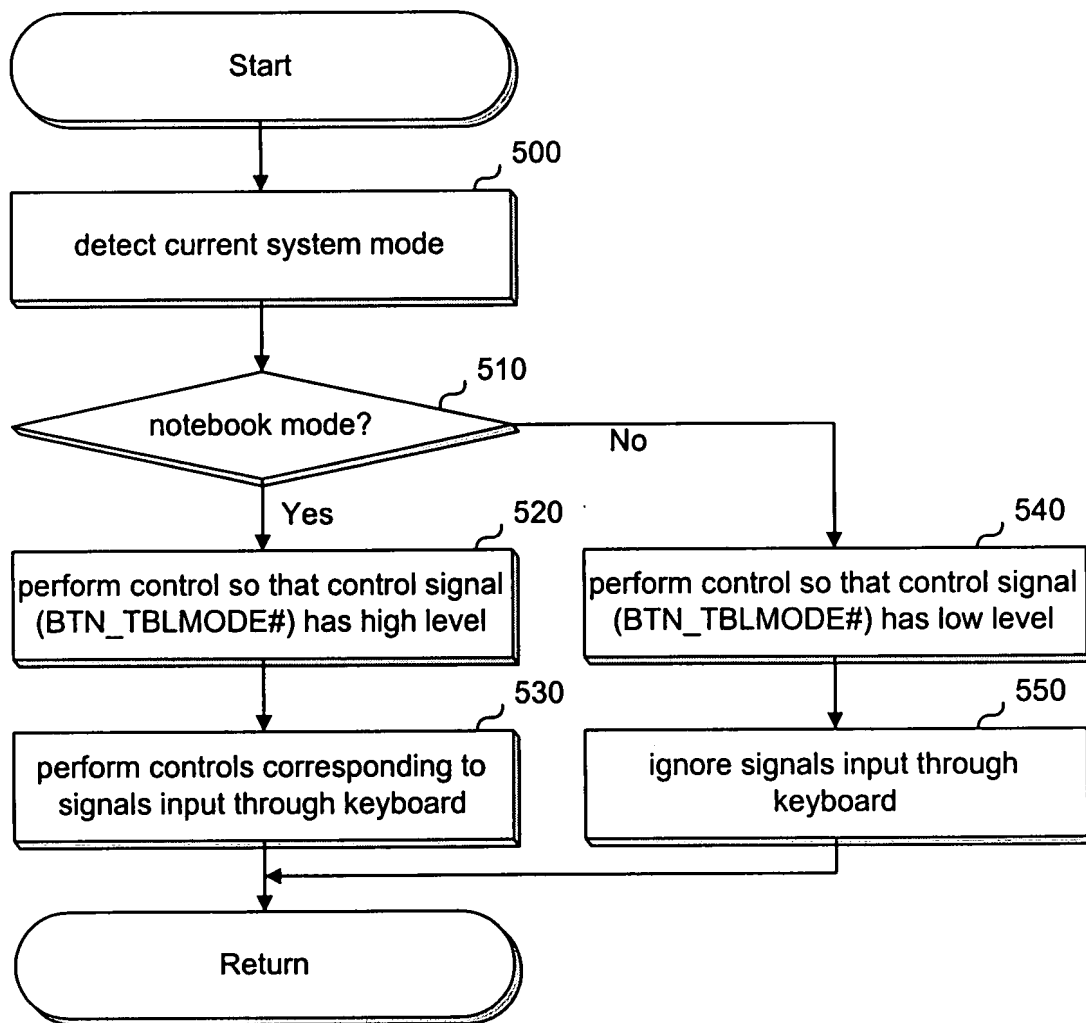


**FIG. 3**



**FIG. 4**

Mode	Notebook Computer Mode	Tablet Computer Mode
NTB_TBL_Mode#	High	Low
Keyboard	Activation State	Inactivation State

**FIG. 5**



## ABSTRACT

### Summary

The present invention relates to an apparatus and method for booting the system of a convertible computer, which can detect the state of rotation of a display module when the system of the convertible computer is powered on, and can also selectively boot an OS for a tablet computer or an OS for a notebook computer depending on the detected state of rotation of the display module, thus automatically selecting optimal unique OSs for a tablet computer and for a notebook computer in the notebook computer mode and the tablet computer mode, and consequently booting and operating the system. Accordingly, the present invention is a very useful invention for allowing a user, having the convertible computer, to efficiently use various inherent functions and operations depending on respective modes.

### Key Figure

Figure 3

### Key Words

convertible computer, OS for tablet computer, OS for notebook computer, display module, rotation switch, keyboard controller, BIOS

## SPECIFICATION

### 25 Title

APPARATUS AND METHOD FOR BOOTING SYSTEM OF CONVERTIBLE COMPUTER

### Brief Description Of The Drawings

FIG. 1 is a view showing the state in which a typical convertible computer is used in a notebook computer mode;

FIG. 2 is a view showing the state in which a typical convertible computer is used in a tablet computer mode;

FIG. 3 is a diagram showing the construction of an apparatus for booting the system of a convertible computer according to the present invention; and

FIG. 4 is a flowchart showing the operation of a method of booting the system of a convertible computer according to the present invention.

#### Major Elements In Drawings

	10: OS	11: hard disc
10	12: BIOS	13: keyboard controller
	14: rotation switch	

#### Background Of The Invention

The present invention relates to an apparatus and method for booting the system of a convertible computer, which can selectively use a notebook computer mode and a tablet computer mode depending on the state of rotation of a display module, in which an LCD and a digitizer are integrated with each other.

Recently, a convertible computer, allowing a user to conveniently and selectively use the function of a notebook computer and the function of a tablet computer, has been developed, marketed and commercialized.

Such a convertible computer includes a display module, in which a Liquid Crystal Display (LCD) for displaying video images and various menu screens, and a digitizer for allowing a user to selectively input various menu items displayed on the LCD by touching the menu items with an electronic pen or the like, are integrated with each other.

Further, as shown in FIG. 1, the display module can be rotated through the selection of the user. For example, when desiring to use the convertible computer as a notebook

computer, the user performs a desired function and operation using a keyboard KBD and a touch pad provided on the main body of the convertible computer after fixing the display module in the same state as the LCD of a typical notebook  
5 computer.

Meanwhile, when desiring to use the convertible computer as a tablet computer, the user touches various menu items displayed on the LCD with an electronic pen or the like after rotating the display module, as shown in FIG. 2. In this case,  
10 a digitizer, installed on the front or rear side of the LCD, detects coordinate values at the location of the LCD, which is touched with the electronic pen, so that the function and operation desired by the user can be performed.

Accordingly, the user having the convertible computer  
15 can conveniently selectively use the convertible computer as a tablet computer or a notebook computer by rotating the display module.

However, in a convertible computer, a system is generally booted using a single fixed Operating System (OS),  
20 such as Windows 98 or Windows XP. Accordingly, when the convertible computer is used in an arbitrary mode depending on the state of rotation of the display module, for example, a tablet computer mode, an optimal unique OS suitable for the tablet computer mode is not booted, and thus there is a  
25 problem in that various functions and operations cannot be provided.

#### Explanation Of The Invention

Accordingly, the present invention has been made keeping in mind the above problems, and an object of the present  
30 invention is to provide an apparatus and method for booting the system of a convertible computer, which can identify a notebook computer mode and a tablet computer mode depending

on the state of rotation of a display module, in which an LCD and a digitizer are integrated with each other, in the convertible computer, and which automatically select a unique OS for a tablet computer (TB\_OS) and a unique OS for a  
5 notebook computer (NB\_OS), which are optimal for the respective modes, thus booting the system.

In order to achieve the above object, an apparatus for booting a system of a convertible computer according to the present invention is characterized in that it comprises  
10 detection means for detecting a state of rotation of a display module when a system of the convertible computer is powered on, and control means for selectively booting an Operating System (OS) for a tablet computer or an OS for a notebook computer depending on results of the detection.

15 Further, a method of booting a system of a convertible computer according to the present invention is characterized in that it comprises a first step of detecting a state of rotation of a display module when a system of the convertible computer is powered on, and a second step of selectively  
20 booting an Operating System (OS) for a tablet computer or an OS for a notebook computer depending on the detected state of rotation.

25 Hereinafter, embodiments of an apparatus and method for booting a system according to the present invention will be described in detail with reference to the attached drawings.

First, the apparatus and method for booting a system according to the present invention can be applied to a  
30 convertible computer, which can selectively use a notebook computer mode and a tablet computer mode depending on the state of rotation of a display module, in which an LCD and a digitizer are integrated with each other, as described above

with reference to FIGS. 1 and 2.

As shown in FIG. 3, the system booting apparatus for the convertible computer according to the present invention includes an Operating System (OS) 10, a hard disc 11, a Basic Input Output System (BIOS) 12, a keyboard controller 13, and a rotation switch 14. The rotation switch 14 is turned on/off depending on the state of rotation of the display module, in which the LCD and the digitizer are integrated with each other.

10 In detail, the rotation switch 14 can be turned on/off by a magnetic sensor for electrically detecting the state of rotation of the display module, or through mechanical contact, and the keyboard controller 13 can be implemented using a microcomputer or the like.

15 Further, the keyboard controller 13 determines that the display module is rotated to be in the state of a tablet computer mode, as described above with reference to FIG. 2, when a rotation detection signal, generated depending on whether the rotation switch 14 is turned on/off, for example, 20 the rotation detection signal Rotate# generated when the rotation switch is turned on, is output as a high level signal.

In contrast, when the rotation switch is turned off and the rotation detection signal Rotate# is output as a low 25 level signal, the keyboard controller 13 determines that the display module is rotated to be in the state of a notebook computer mode, as described above with reference to FIG. 1.

Meanwhile, when the notebook computer mode is set through the interface with the keyboard controller, the BIOS 30 12 selects an OS for a notebook computer (NB\_OS) stored in the hard disc 11, uploads the OS to Random Access Memory (RAM), and allows the system to be booted and operated through the OS for the notebook computer.

In contrast, when the tablet computer mode is set through the interface with the keyboard controller, the BIOS 12 selects an OS for a tablet computer (TB\_OS) stored in the hard disc 11, uploads the OS to the RAM, and allows the system to be booted and operated through the OS for the tablet computer, thus allowing the user to efficiently use various inherent functions and operations in each mode. This process is described in detail.

FIG. 4 is a flowchart showing the operation of a method of booting the system of a convertible computer according to the present invention. As described above, when the user having a convertible computer, which is implemented to conveniently and selectively use a notebook computer mode or a tablet computer mode depending on the state of rotation of a display module, powers on the system of the convertible computer in step S10, the keyboard controller 13 checks the level of a rotation detection signal Rotate# generated depending on the On/Off state of the rotation switch 14, and thus detects the state of rotation of the display module in step S11.

For example, when the level of the rotation detection signal Rotate#, detected immediately after the system is powered on, is low, the keyboard controller 13 determines that the rotation switch 14 is turned off in step S12, and determines that the state of rotation of the display module is set to the notebook computer mode, as shown in FIG. 1, in step S13.

Meanwhile, the BIOS 12 performs a series of operations of reading an OS for a notebook computer (NB\_OS) from the OS for the notebook computer (NB\_OS) and an OS for a tablet computer (TB\_OS), which are stored in the hard disc 11, through the interface with the keyboard controller 13, uploading the read OS for the notebook computer (NB\_OS) to

the RAM 10, and allowing the system to be booted and operated through the OS for the notebook computer in step S14.

In contrast, when the level of the rotation detection signal Rotate#, detected immediately after the system is powered on, is high, the keyboard controller 13 detects that the rotation switch 14 is turned on in step S15, and determines that the state of rotation of the display module is set to the tablet computer mode, as shown in FIG. 2, in step S16.

10 Further, the BIOS 12 performs a series of operations of reading the OS for the tablet computer (TB\_OS) from the OS for the notebook computer (NB\_OS) and the OS for the tablet computer (TB\_OS), which are stored in the hard disc 11, through the interface with the keyboard controller 13,  
15 uploading the read OS for the tablet computer (TB\_OS) to the RAM 10, and allowing the system to be booted and operated through the OS for the tablet computer in step S17.

After the above-described booting operation has been normally performed in step S18, the OS for the notebook  
20 computer provides optimal unique functionality and operations suitable for the notebook computer mode to the user, or provides optimal unique functionality and operations suitable for the tablet computer mode to the user when the OS for the tablet computer is booted in step S19.

25

Although the preferred embodiments of the present invention have been disclosed for illustrative purposes, those skilled in the art will appreciate that various modifications, additions and substitutions are possible,  
30 without departing from the scope and spirit of the invention as disclosed in the accompanying claims.

**Effect Of The Invention**

The apparatus and method for booting the system of a convertible computer according to the present invention, having the above construction, can detect the state of rotation of a display module when the system of the convertible computer is powered on, and can also selectively boot an OS for a tablet computer or an OS for a notebook computer depending on the detected state of rotation of the display module, thus automatically selecting optimal unique OSs for a tablet computer and for a notebook computer in the notebook computer mode and the tablet computer mode, and consequently booting and operating the system. Accordingly, the present invention is a very useful invention for allowing a user, having the convertible computer, to efficiently use various inherent functions and operations depending on respective modes.

**WHAT IS CLAIMED IS:**

1. A method of booting a system of a convertible computer, comprising:
  - a first step of detecting a state of rotation of a display module when a system of the convertible computer is powered on; and
  - a second step of selectively booting an Operating System (OS) for a tablet computer or an OS for a notebook computer depending on the detected state of rotation.
2. The method according to claim 1, wherein the first step is performed such that the state of rotation of the display module is detected by a rotation switch, which is turned on/off by a magnetic sensor for monitoring the state



of rotation of the display module, or which is turned on/off through mechanical contact.

3. The method according to claim 1, wherein the second  
5 step is performed such that, when the detected state of rotation of the display module corresponds to a tablet computer mode, the OS for the tablet computer is selected and booted.

10 4. The method according to claim 1, wherein the second step is performed such that, when the detected state of rotation of the display module corresponds to a notebook computer mode, the OS for the notebook computer is selected and booted.

15

5. An apparatus for booting a system of a convertible computer, comprising:

detection means for detecting a state of rotation of a display module when a system of the convertible computer is  
20 powered on; and

control means for selectively booting an Operating System (OS) for a tablet computer or an OS for a notebook computer depending on results of the detection.

25 6. The apparatus according to claim 5, wherein the detection means comprises a rotation switch, which is turned on/off by a magnetic sensor for monitoring the state of rotation of the display module, or which is turned on/off through mechanical contact, and a keyboard controller for  
30 detecting an On/Off state of the rotation switch.

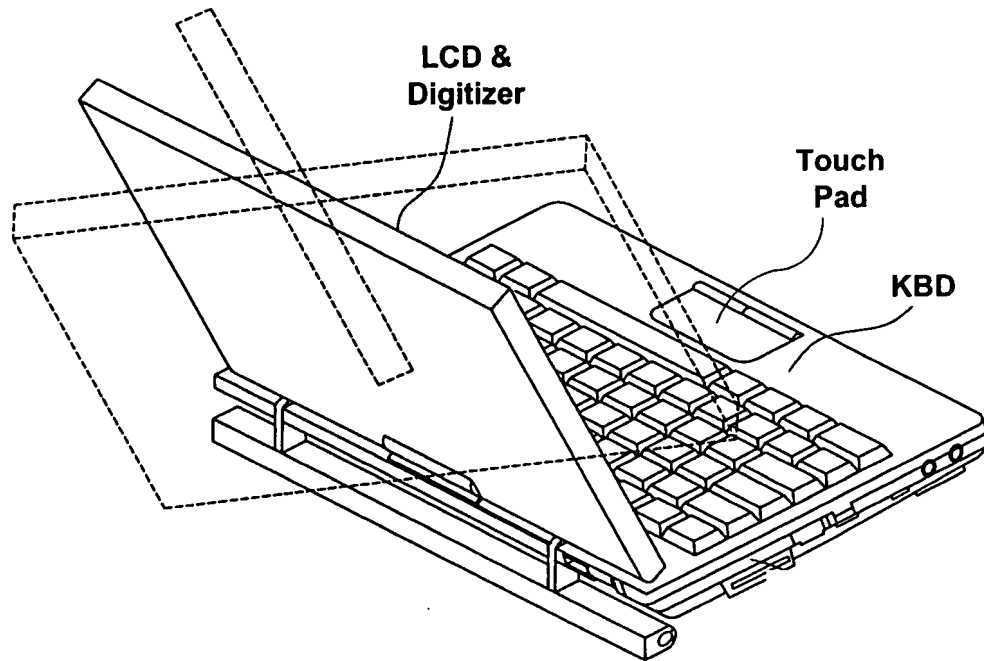
7. The apparatus according to claim 5, wherein the control means is a Basic Input Output System (BIOS) for

selecting and booting the OS for the tablet computer when the detected state of rotation of the display module corresponds to a tablet computer mode.

- 5        8. The apparatus according to claim 5, wherein the control means is a BIOS for selecting and booting the OS for the notebook computer when the detected state of rotation of the display module corresponds to a notebook computer mode.

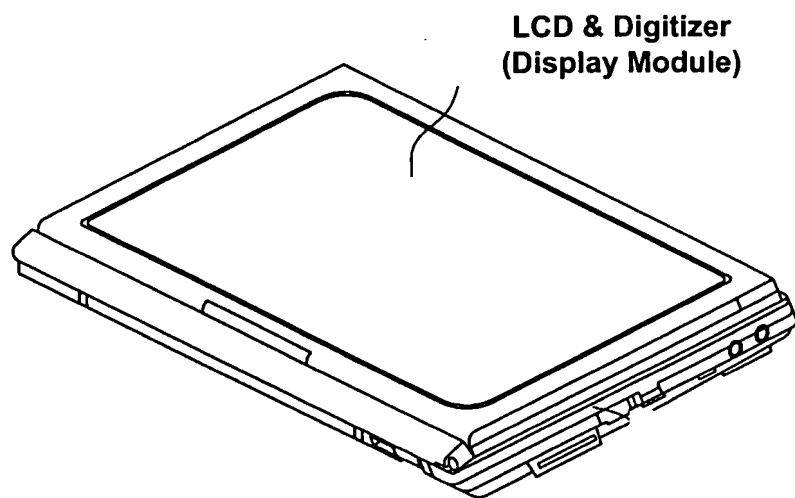
**FIG. 1**

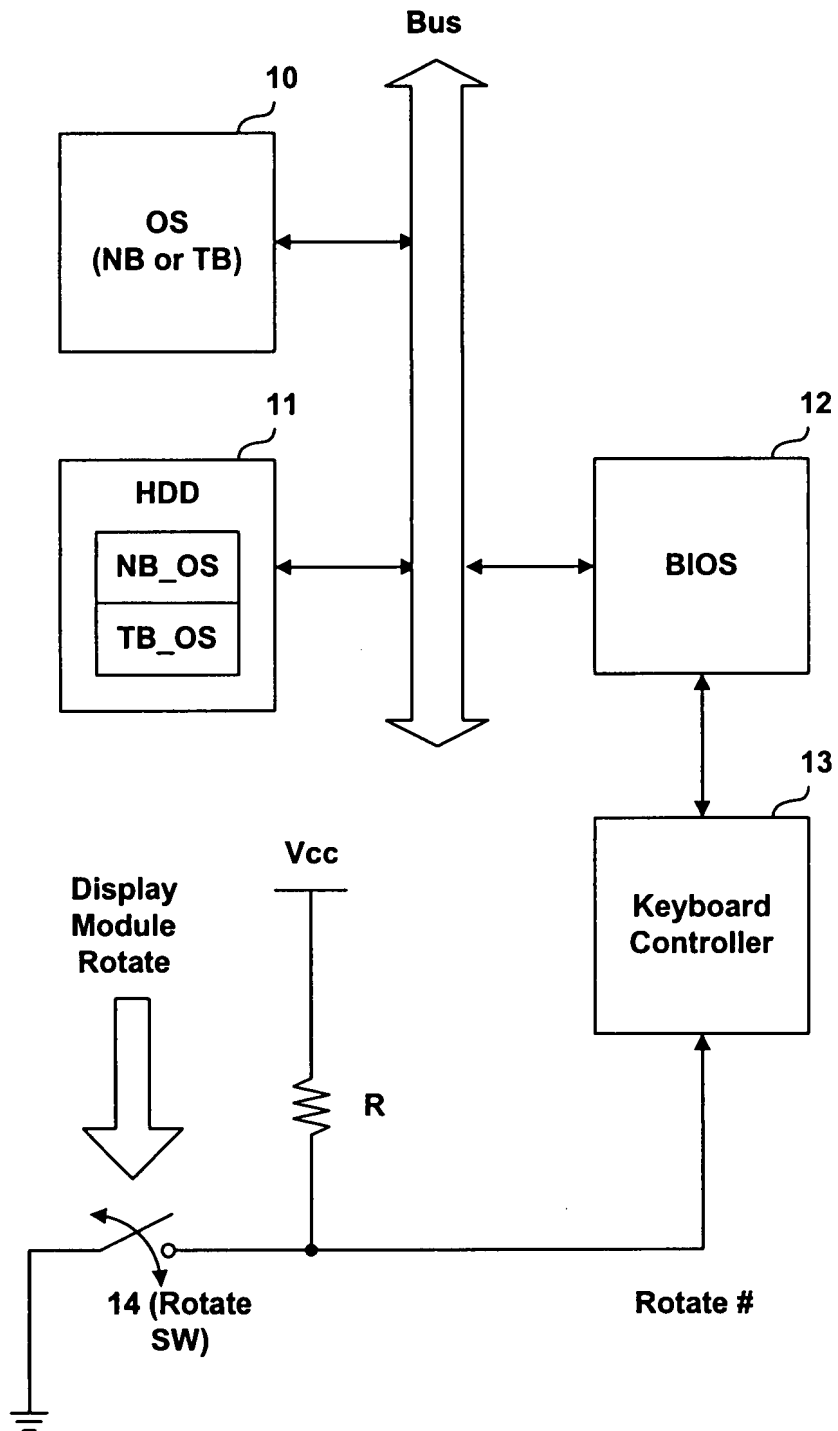
**Notebook Computer Mode**

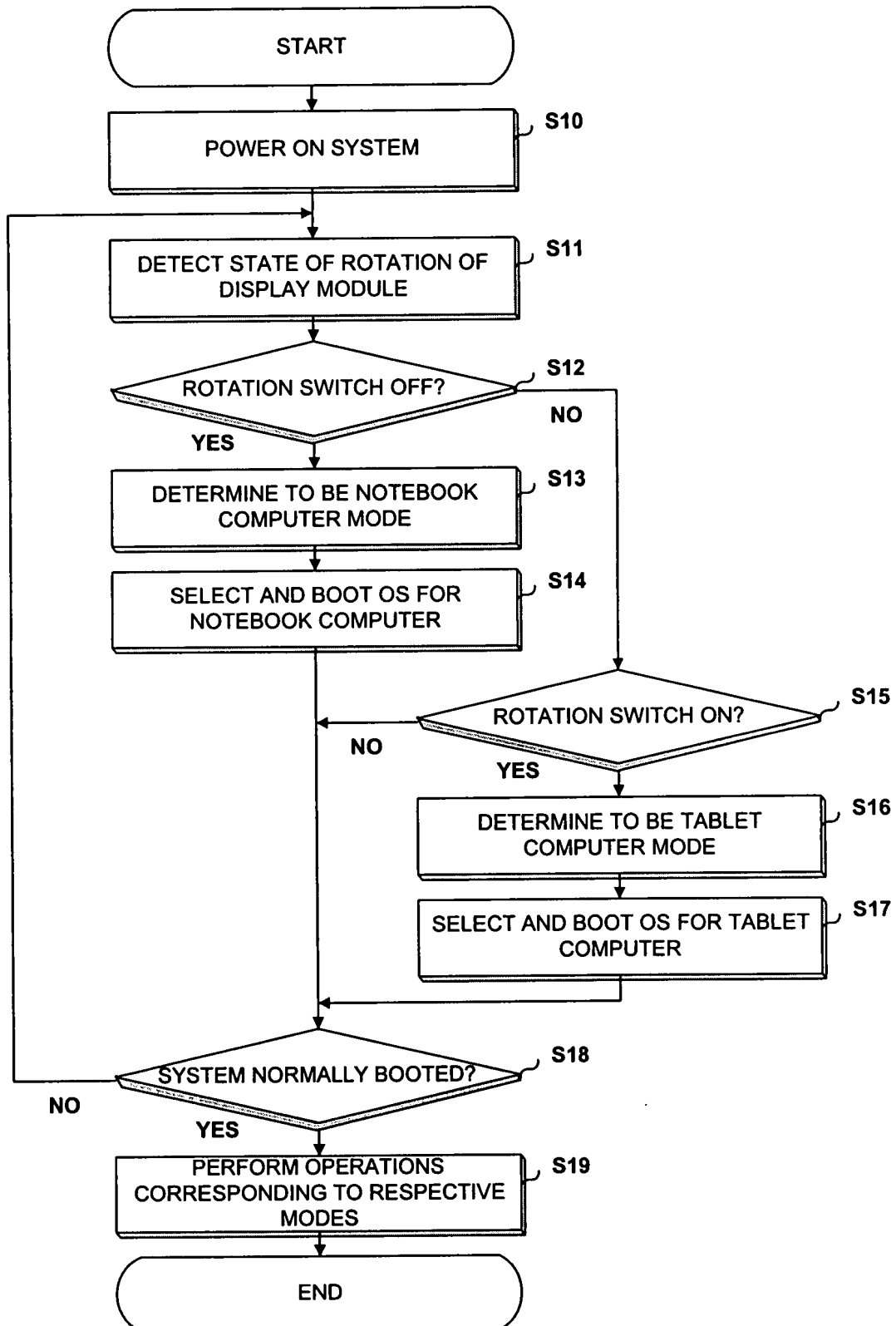


**FIG. 2**

**Tablet Computer Mode**



**FIG. 3**

**FIG. 4**

**ABSTRACT****Summary**

The present invention relates to a mode management method and apparatus for a convertible computer, which efficiently manage two different modes in a convertible computer, which is used both as a tablet computer and a notebook computer. The present invention is characterized in that a convertible computer, having both the function of a notebook computer and the function of a tablet computer, has a notebook mode and a tablet mode, and performs a control operation so that the environments of the system are automatically set up depending on respective modes. For this operation, the present invention includes a component for monitoring the switching of the mode, a system environment setup unit for setting up the environment of the system in the switched mode, and memory for storing control values required for the setup of environments in respective modes.

**Key Figure**

FIG. 3

**Key Words**

Notebook, tablet, mode control

## SPECIFICATION

### Title

MODE MANAGEMENT METHOD AND APPARATUS FOR CONVERTIBLE COMPUTER

5

### Brief Description Of The Drawings

FIG. 1 is a perspective view of a convertible computer in a notebook mode according to the present invention;

10 FIG. 2 is a perspective view of a convertible computer in a tablet mode according to the present invention;

FIG. 3 is a control diagram of a mode management apparatus for a convertible computer according to the present invention;

FIG. 4 is a diagram showing an example of data stored in memory according to the present invention; and

FIG. 5 is a control flowchart showing a mode management method for a convertible computer according to the present invention.

### Major Elements In Drawings

3: switching sensor	5: memory
7: microcontroller	9: system control unit
11: fan	13: central processing unit
15: temperature sensor	

### Background Of The Invention

The present invention relates, in general, to a mode management method and apparatus for a convertible computer, and, more particularly, to a mode management method and apparatus for a convertible computer, which efficiently

manage two different modes in a convertible computer, which is used both as a tablet computer and as a notebook computer.

A tablet computer is designed so that it combines all of the advantages of a desktop computer, a notebook computer, a hand-held device, etc. with each other. That is, a notebook computer can be used only when the main body thereof is placed on a support surface, although it is a mobile computer. In contrast, a tablet computer has excellent mobility and convenience in that it can be used with the tablet computer held in the hand, like a Personal Digital Assistant (PDA) and in that data can be directly recorded through a monitor using an electronic pen, instead of a keyboard. Further, because all of the basic components of the tablet computer are included in the monitor, the tablet computer can have a simpler appearance, and because the tablet computer is implemented using a touch screen, it is convenient in that there is no need to use an input device, such as a separate mouse.

In this way, since a notebook computer and a tablet computer have different purposes and uses, separate markets for them have been formed, and they have been independently implemented and used with different specifications. Therefore, when the notebook computer and the tablet computer are implemented together in a single system, management methods corresponding to respective usage modes are required.

#### **Explanation Of The Invention**

Accordingly, an object of the present invention is to provide a mode management method and apparatus for a convertible computer, which can efficiently perform management operations corresponding to respective modes in



the convertible computer, in which both a notebook computer and a tablet computer are implemented in a single system.

In order to achieve the above object, the present invention provides a mode management apparatus for a convertible computer, having a function of a notebook computer and a function of a tablet computer, comprising mode switching monitoring means for monitoring switching of a system mode; system environment setup means for setting up an environment of a system in a switched mode; and memory for storing control values required for setup of environments in respective modes.

The system environment setup means may set a rate of a central processing unit, a temperature of the system, and a speed of a fan.

The system mode may be switched through selection of a user, and the switched system mode may be stored in a Complimentary Metal Oxide Semiconductor (CMOS) setup menu.

The mode switching monitoring means may be implemented using a keyboard controller.

In addition, the present invention provides a mode management method for a convertible computer having a function of a notebook computer and a function of a tablet computer, comprising a mode switching monitoring step of monitoring switching of a system mode; a reading step of reading a control value required for setup of an environment of a switched mode from memory; and a system environment setup step of setting up an environment of the system based on the read control value.

Hereinafter, a mode management method and apparatus for a convertible computer according to the present invention will be described in detail with reference to the attached drawings.

FIGS. 1 and 2 are perspective views showing a

convertible computer according to the present invention.

The convertible computer according to the present invention is used as a tablet computer when a display unit 30 is rotated and the front side of the display unit 30 faces upward, as shown in FIG. 2. Further, the convertible computer is used as a notebook computer when the display unit 30 stands vertically and faces forward, as shown in FIG. 1.

Therefore, the state of FIG. 1 indicates a notebook mode, in which the display unit 30 faces forward, so that an input operation is performed using a keyboard 20 or the like. Further, in a tablet mode, the display unit 30 is rotated around a shaft (not shown), as shown in the dotted line of FIG. 1. At this time, the rear side of the display unit 30 is seated on the top of a main body 10, and thus the state in which the front side of the display unit 30 faces upwards when an electronic appliance is placed on a support surface is realized. In this state, an input operation can be performed through the display unit 30 using a stylus pen.

Meanwhile, the convertible computer is used by causing the display unit 30 to be rotated when the mode is switched from a notebook mode to a tablet mode, or from a tablet mode to a notebook mode. Although not shown in detail in the drawings, a contact switch between the display unit 30 and the main body unit 10 is operated to monitor the switching of the mode of the system when the above operation is performed.

FIG. 3 is a diagram showing mode control performed in a convertible computer according to the present invention.

As shown in the drawing, the convertible computer includes a Central Processing Unit (CPU) 13 for performing overall control of all functions provided in the system

thereof, and a system control unit 9, including a core chipset for performing the function of transmitting data between the CPU 13, and memory, a microcontroller and various peripherals, which will be described later, and for  
5 controlling the components. Further, the notebook computer includes a microcontroller 7 for controlling an input device, such as a keyboard or a mouse, and controlling battery power, a battery interface, etc.

Further, the convertible computer includes non-  
10 volatile memory (flash memory) 5, which enables reading and writing and retains information even if power is interrupted, and which stores therein various routines required when the computer is booted, and programs and data required for basic operations which must be repeatedly used  
15 every time. The non-volatile memory 5 stores a Basic Input/Output System (BIOS), which is a kind of program for managing information transmission between peripherals, such as memory, a disc, and a monitor, the states of respective conditions required for setting a power management mode,  
20 and suitable power management modes corresponding to respective conditions, in conjunction with each other.

Further, the convertible computer according to the present invention includes a switching sensor 3 for monitoring the operation of switching between a notebook  
25 mode and a tablet mode. As described above, the switching sensor 3 is implemented using a switch, the contact point of which is turned on/off through the rotating operation of the display unit 30. A sensed signal output from the switching sensor 3 is input to the microcontroller 7, which  
30 is a keyboard controller. The microcontroller 7 recognizes the mode to be controlled in response to the sensed signal output from the switching sensor 3, and thus performs the control according to the recognized mode.

Further, the memory 5 of the present invention stores a control value for the notebook mode and a control value for the tablet mode. The values stored in the memory 5 include the rates of the CPU, the speeds of a fan, the 5 temperatures of the system, etc. with respect to respective modes.

This system temperature is a temperature based on heat generated during the use of the system, including the CPU, and is a value set in a temperature sensor to allow 10 the system to recognize the temperature. The system temperature is set in consideration of surface temperature specs and offset values relative to the temperature sensor depending on respective modes.

The control values for respective modes, as shown in 15 FIG. 4, are represented only by relative values. That is, the rate of the CPU is set to a low rate in the tablet computer mode, but it must be set to a rate relatively higher than that of the tablet computer mode in the notebook computer mode. Further, the system temperature is 20 set to a low temperature in the tablet computer mode, but it must be set to a temperature relatively higher than that of the tablet computer mode in the notebook computer mode. In addition, the fan speed is set to a low speed in the tablet computer mode, but it must be set to a speed 25 relatively higher than that of the tablet computer mode in the notebook computer mode.

Meanwhile, the control values for respective modes of FIG. 4 are represented only by values relative to those of the tablet mode in the notebook mode, and, inversely, only 30 by values relative to those of the notebook mode in the tablet mode. However, it is preferable that the control values be controlled in several stages within actual allowable ranges of maximum values in each mode after the

allowable ranges have been determined.

For example, it is preferable that the ranges of detected temperatures for the system temperature be determined, and that the rates of the CPU and the fan be  
5 determined with respect to respective detected temperature ranges. Therefore, when the system temperature falls within range A, the rate of the CPU may be set to B, and the speed of the fan may be set to C. In this case, the CPU rate and the fan speed are adjusted within the  
10 allowable range.

Moreover, the convertible computer of the present invention includes a temperature sensor 15 for sensing the temperature of the CPU 13, and a cooling fan 11 for dissipating heat generated in the system. Further, the  
15 system control unit 9 sets up the environment of the system to correspond to the current system mode under the control of the microcontroller 7. Therefore, the system control unit 9 includes a clock generator, other logic circuits, and a BIOS and utilities for operating the clock generator  
20 and the logic circuits, in addition to the core chipset used in the notebook computer.

The memory 5 shown in the embodiment of the present invention can also be implemented using a Read Only Memory (ROM) BIOS. Further, values set in the ROM BIOS are  
25 preferably stored in the CMOS of the chipset included in the system control unit 9. Further, a menu item required to identify the current system mode is set in a CMOS setup menu, and the system environment is controlled depending on whether a set value corresponds to the notebook mode or the  
30 tablet mode.

Next, an operating process based on mode management for a convertible computer according to the present invention, having the above construction, is described.

FIG. 5 is a flowchart showing operation based on mode management for a convertible computer according to the present invention.

When power is supplied to the system, the system control unit 9 detects the supply of power, and applies a wakeup signal to the CPU 13. The CPU 13 controls an initial booting operation in response to the wakeup signal. In this case, during the initial booting operation, the environment of the system is set up through the ROM BIOS stored in the memory 5. The ROM BIOS recognizes and controls the current system mode set in the CMOS setup menu in step 500.

The current system mode, recognized in step 500, is provided to the system control unit 9. The system control unit 9 reads the control value corresponding to the current system mode in step 510. The mode control value is stored in the memory 5. Further, the status of the current system is set based on the read mode control value. When the current mode is a notebook mode, the rate of the CPU is set to a high rate, the speed of the fan is set to a high speed, and the temperature of the system is set to a high temperature in steps 520, 530, and 540.

Thereafter, the system is operated in the notebook mode in step 550, and the user inputs various signals using the keyboard 20. The input signals are displayed on the display unit 30 under the control of the CPU 13.

In this case, the clock cycle of the CPU 13 is adjusted in response to a CPU clock control signal obtained under the control of the system control unit 9, and thus the operating rate of the CPU 13 is determined. The CPU 13 controls various types of signal processing while operating at the set rate. Heat generated in the system during this process is sensed by the temperature sensor 15. The heat

sensed by the temperature sensor 15 is applied to the microcontroller 7. The microcontroller 7 controls the speed of the cooling fan 11 within the speed range of the cooling fan 11 allowed in the notebook mode on the basis of  
5 the heat sensed by the temperature sensor 15, thus dissipating the heat generated through the operation of the system.

Generally, when the temperature of heat generated due to the operation of the system is high, the speed of the  
10 cooling fan 11 increases, whereas, when the temperature of the generated heat is low, the speed of the cooling fan 11 decreases. Further, when the temperature of the heat generated due to the operation of the system is high, the allowable range of the clock signal of the CPU is narrowed,  
15 whereas, when the temperature of the generated heat is low, the allowable range of the clock signal of the CPU is widened.

Meanwhile, when the mode switches from the notebook mode to the tablet mode, the display unit 30 is rotated,  
20 and thus the state of FIG. 1 changes to that of FIG. 2. In this case, the output signal of the switching sensor 3, required for the detection of the system mode, is switched. The microcontroller 7 continues to monitor the operating status of the switching sensor 3, detects the switching of  
25 the current mode when the current mode is switched through the switching sensor 3, and notifies the system control unit 9 of the switching of the current mode by means of an interrupt.

In the present invention, the switching sensor 3 and  
30 the microcontroller 7 are components for monitoring the mode switching of the system. Therefore, there is no need to limit the components to a switching sensor for monitoring the rotating operation of the display unit 30

and a microcontroller, which is a keyboard controller, and the components need only be composed of a sensor capable of detecting variation in the status of the system and a control means capable of identifying the value of the  
5 sensor.

Further, the switched mode is stored in the CMOS setup menu. Thereafter, the system control unit 9 performs a control operation in the changed mode.

As described above, the present invention is  
10 characterized in that a convertible computer, having both the function of a notebook computer and the function of a tablet computer, has both a notebook mode and a tablet mode, and performs a control operation to allow the environment of the system to be automatically set up in respective  
15 modes. For this operation, the present invention includes a mode switching monitoring component for monitoring the switching of a mode, a system environment setup unit for setting up the environment of the system in the switched mode, and memory for storing control values required for  
20 the setup of environments in respective modes.

Through the above description, those skilled in the art will appreciate that various modifications and changes are possible, without departing from the scope and spirit of the invention as disclosed in the accompanying claims.  
25 Therefore, the technical scope of the present invention should be defined by the accompanying claims, without being limited to the detailed description of the present specification.

### 30 Effect Of The Invention

First, the above-described mode management method and apparatus for the convertible computer according to the present invention have two different modes corresponding to



a notebook computer and a tablet computer. Second, the present invention performs management operations that comply with specifications corresponding to respective modes, thus supporting respective modes. Third, the present invention is advantageous in that it can maximize the usability and stability of the system through efficient management techniques performed in respective modes. Finally, the present invention is advantageous in that it can reduce unnecessary power consumption through the efficient control of respective modes, thus efficiently managing the use of power. This advantage is maximized, in particular, in the tablet mode, in which the system is satisfied under conditions inferior to those of the system in the notebook mode.

**What is claimed is:**

1. A mode management apparatus for a convertible computer, having a function of a notebook computer and a function of a tablet computer, comprising:

mode switching monitoring means for monitoring switching of a system mode;

system environment setup means for setting up an environment of a system in a switched mode; and

memory for storing control values required for setup of environments in respective modes.

2. The mode management apparatus according to claim 1, wherein the system environment setup means sets a rate of a central processing unit, a temperature of the system, and a speed of a fan.

3. The mode management apparatus according to claim 1, wherein the system mode is switched through selection of a

user, and the switched system mode is stored in a Complimentary Metal Oxide Semiconductor (CMOS) setup menu.

4. The mode management apparatus according to any of  
5 claims 1 to 3, wherein the mode switching monitoring means is implemented using a keyboard controller.

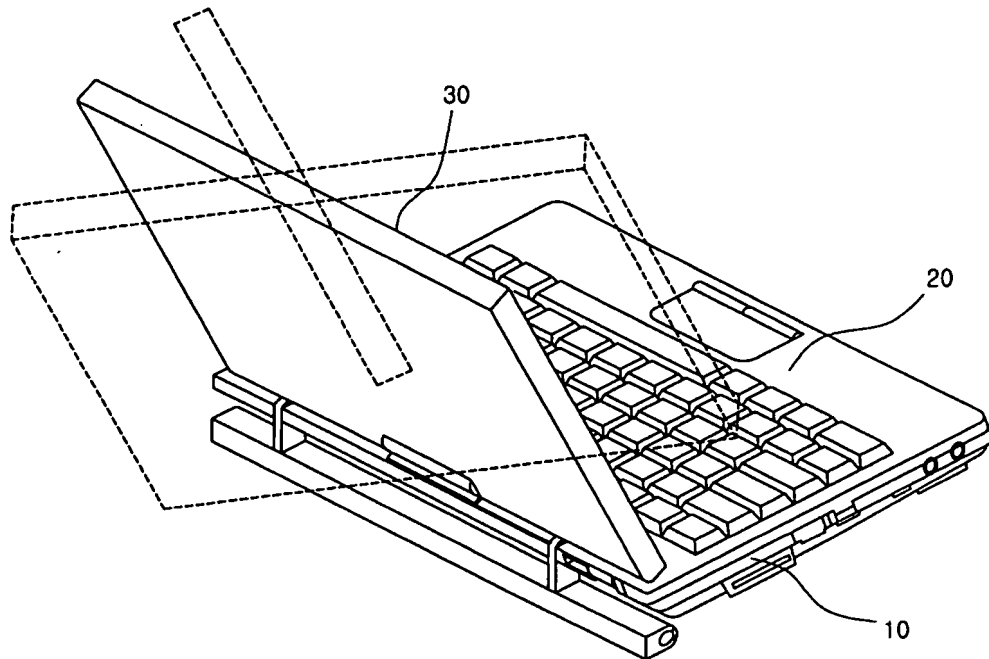
5. A mode management method for a convertible  
computer having a function of a notebook computer and a  
10 function of a tablet computer, comprising:

a mode switching monitoring step of monitoring  
switching of a system mode;

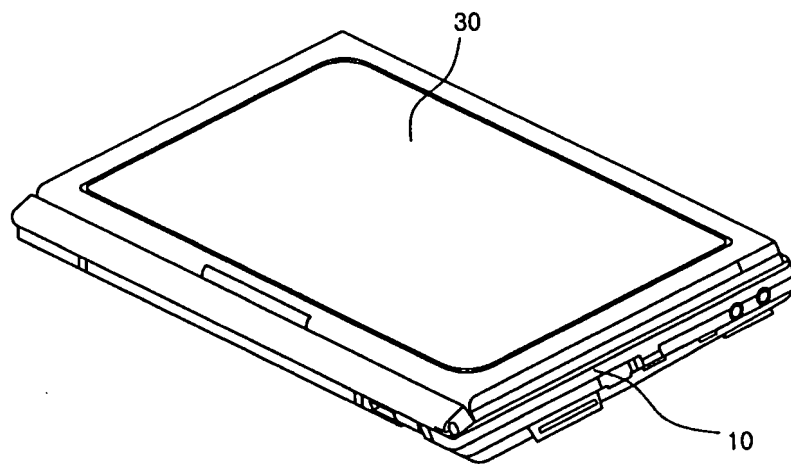
a reading step of reading a control value required  
for setup of an environment of a switched mode from memory;  
15 and

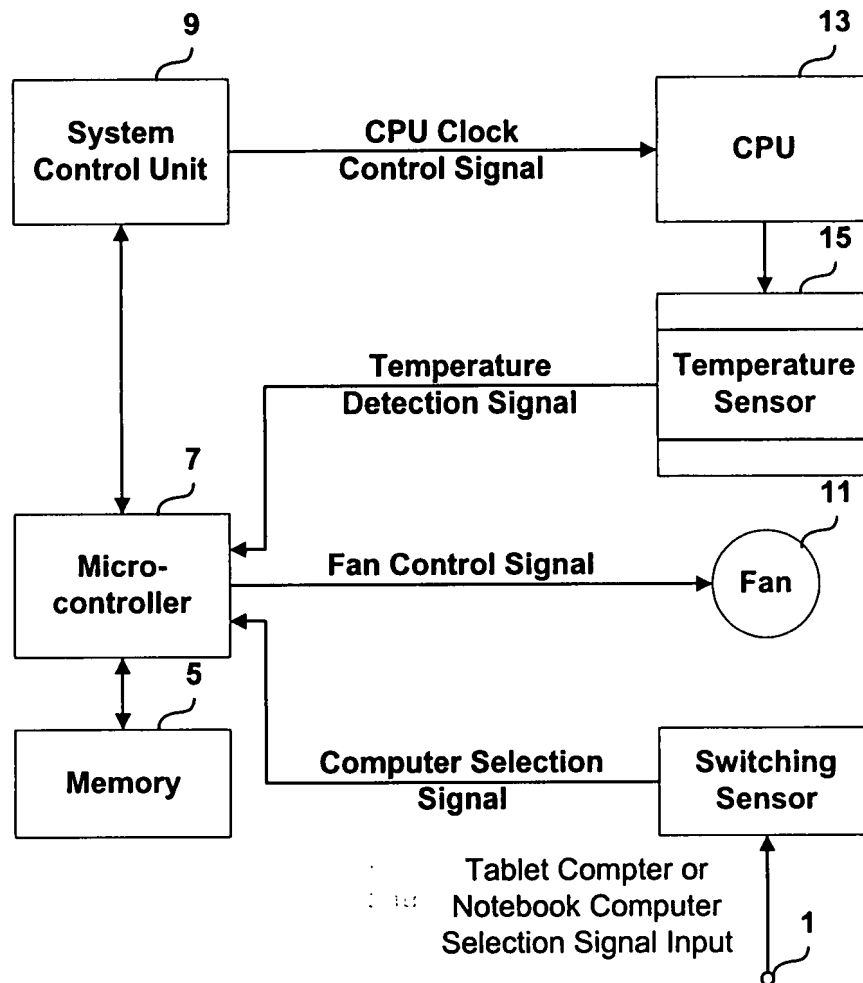
a system environment setup step of setting up an  
environment of the system based on the read control value.

**FIG. 1**

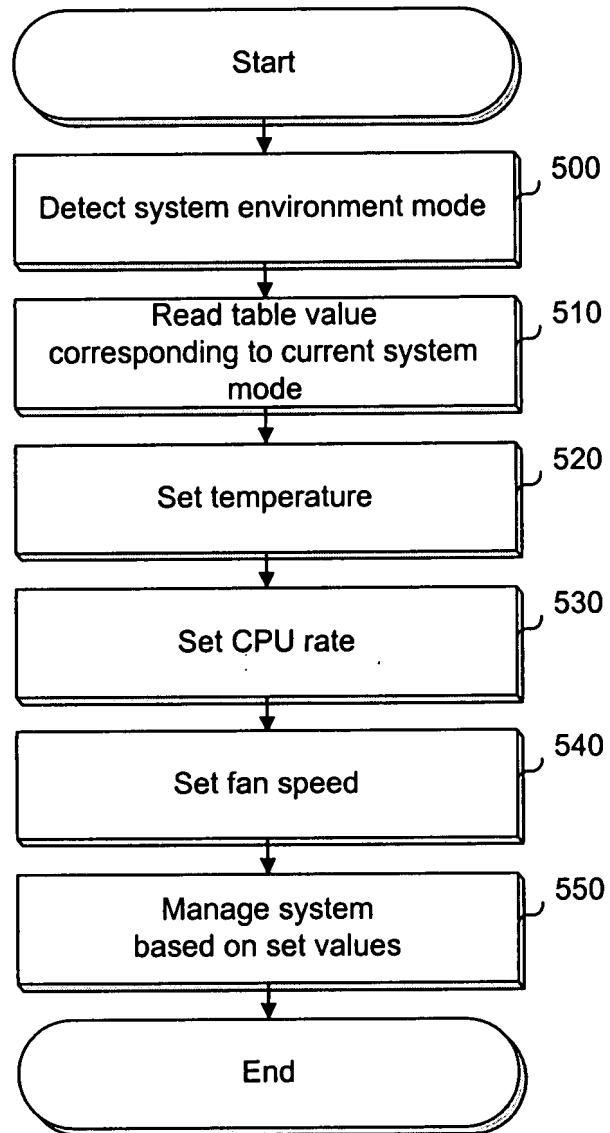


**FIG. 2**



**FIG. 3****FIG. 4**

Mode	Tablet Computer	Notebook Computer
CPU Rate	Low	High
Temperature	Decreased	Increased
Fan Speed	Low	High

**FIG. 5**

## ABSTRACT

### Summary

The present invention relates to a protection circuit for a convertible target computer, which can prevent erroneous operation from occurring when an LCD panel is closed in a product in which a notebook computer and a tablet computer are implemented together. The protection circuit for a convertible tablet computer according to the present invention is characterized in that it prevents erroneous operation from occurring in a system due to the operation of a switch for detecting the closing/opening of the LCD panel when the computer is used, either as a typical computer or in a tablet mode. For this operation, in the present invention, a simple logic circuit is implemented, and the erroneous operation of the system is prevented without requiring a separate mechanical device.

### Key Figure

FIG. 2

### Key Words

tablet computer, LCD

## SPECIFICATION

### Title

PROTECTION CIRCUIT FOR CONVERTIBLE TABLET COMPUTER

### Brief Description Of The Drawings

FIG. 1 is a circuit diagram of a circuit for detecting the state of the closing of an LCD panel in a conventional notebook computer;

FIG. 2 is a control diagram showing a protection circuit for a convertible tablet computer;

FIG. 3 is a diagram showing the configuration of a logic element used in the present invention; and

5 FIG. 4 is a view showing the operation table of the logic element used in the present invention.

#### Major Elements In Drawings

R3 to R9: resistor	SW11, SW12: switch
10 C1: capacitor	Q1: transistor
15: AND gate	20: logic element

#### Background Of The Invention

The present invention relates, in general, to a protection circuit for a convertible tablet computer and, more particularly, to a protection circuit for a convertible tablet computer, which can prevent erroneous operation from occurring when an LCD panel is closed, in a product in which a notebook computer and a tablet computer are implemented together.

The development of information and technology is stimulating the use and development of portable devices, such as notebook computers and Personal Digital Assistants (PDAs). In particular, as the fast transmission of information and prompt and precise processing of information have recently become required, information devices meeting these requirements have been developed. One of these information devices is a tablet computer. A tablet computer also provides the function of allowing a user to conveniently use the tablet computer like paper, in addition to a typical computer function. That is, the user records text or a picture on the screen pad of the tablet computer, like writing text or drawing a picture on paper,

and the text or picture, recorded in this way, can be stored in memory or can be transmitted.

Therefore, in the present invention, a convertible tablet computer in which the tablet computer and a typical  
5 notebook computer are implemented together is described.

FIG. 1 is a control diagram showing an operation of causing a system to enter a suspend mode using a switch operating when an LCD panel is closed in a conventional notebook computer.

10 As shown in FIG. 1, a switch SW1 operating when the LCD panel is closed is interposed between a ground and a power supply terminal Vcc. Further, a resistor R1 is interposed between the switch SW1 and the power supply terminal, and a resistor R2 is connected to a connection  
15 node coupled to the resistor R1. The first end of the resistor R2 is connected to the first terminals of a capacitor C1 and an AND gate 10. The second terminal of the capacitor C1 is connected to the ground. An output terminal 12 connected to a connection node between the  
20 resistor R2 and the capacitor C1 transmits a closing signal or an opening signal for the LCD panel to the control unit (not shown) of the system.

A typical notebook computer is constructed such that, when the LCD panel is closed, the switch SW1 is turned on,  
25 and when the LCD panel is opened, the switch SW1 is turned off.

Therefore, when the user switches the LCD panel from an opened state to a closed state, the switch SW1 switches from an Off state to an On state. Supply power from the  
30 power supply terminal Vcc flows to the ground through the resistor R1 and the switch SW1 because of the switching operation of the switch SW1, and thus an output signal at the output terminal 12 makes a transition to a low level



signal.

The low level signal is input to a control unit (not shown), which detects the closing of the LCD panel, and performs operations that are preset to be controlled when the LCD panel is closed. Since the LCD panel is typically controlled so that it is in a closed state when the user is not using the computer for a short time, the system switches to a suspend mode. Further, unnecessary power consumption is reduced by performing a control operation to turn off the backlight of the LCD panel.

Further, when the user switches the LCD panel from the closed state to the opened state again, the switch SW1 also switches the operating state thereof to an Off state. Through this operation, the power from the power supply terminal Vcc flows to the output terminal 12, which transmits a high level signal to the control unit. The control unit releases the system from the suspend state, and controls the system so that it is in a normal operation mode.

As described above, the conventional notebook computer is constructed to include a switch for monitoring the closing/opening operation of the LCD panel and to switch the operation mode of the system on the basis of the operating state of the switch.

However, such control construction may cause the following problem in a notebook computer implemented together with a tablet computer.

A convertible tablet computer is a composite product of a typical notebook computer and a typical tablet computer. Therefore, when the convertible tablet computer is used in a normal mode, it is used as a typical notebook computer, but when it is switched to a tablet mode, the LCD panel must be rotated, which results in the state in which

the LCD panel is closed in a typical notebook computer. Therefore, the convertible tablet computer is problematic in that a switch for monitoring the closing/opening operation of the LCD panel operates when switching to the  
5 tablet mode, thus causing the system to enter the suspend mode or switching the backlight of the LCD panel to an Off state.

#### Explanation Of The Invention

10 Accordingly, an object of the present invention is to provide a protection circuit for a convertible tablet computer, which can prevent erroneous operation from occurring when an LCD panel is closed in a product in which a notebook computer and a tablet computer are implemented together.

15 In order to achieve the above object, the present invention provides a protection circuit for a convertible tablet computer, comprising a first switch for detecting opening and closing operations of a Liquid Crystal Display (LCD) panel; a second switch for detecting rotating  
20 operation of the LCD panel in a tablet mode; a logic element for outputting an opening/closing signal for the LCD panel in response to an On/Off operation signal of the first switch; and a logic element control unit for controlling the logic element so that it is in an enabled  
25 or disabled state in response to an operation of the second switch.

The logic element control unit may comprise a transistor for switching supply of a high level signal to a gate terminal of the logic element in response to the  
30 operation of the second switch.

Hereinafter, a protection circuit for a convertible tablet computer according to the present invention will be

described in detail with reference to the attached drawings.

FIG. 2 is a control diagram showing a protection circuit for a convertible tablet computer according to the present invention.

5 As shown in FIG. 2, a switch SW11, operating when an LCD panel is closed, is interposed between a power supply terminal Vcc, connected through a resistor R3, and a ground. Further, the first end of a resistor R4 is connected to a connection node between the switch SW11 and the resistor R3,  
10 and the second end of the resistor R4 is connected to the first terminal of a capacitor C2 and the input terminal of an AND gate 15. The second terminal of the capacitor C2 is connected to the ground.

A logic element 20 is connected to a connection node  
15 between the resistor R4 and the AND gate 15, and the output terminal of the logic element 20 outputs an LCD panel closing/opening signal LCD\_CLOSE. The logic element 20 is in an enabled state, in which operation is activated, in response to a signal input through the gate terminal  
20 thereof.

Meanwhile, the present invention further includes a switch SW12 for rotating the LCD panel when the computer is used as a tablet computer. The switch SW12 is interposed between a power supply terminal Vcc, connected through a  
25 resistor R5, and the ground. An output terminal 25 is connected to a connection node between the switch SW12 and the resistor R5, and is also connected to the first end of a resistor R7.

The second end of the resistor R7 is connected to the  
30 base terminal of a PNP transistor Q11, and the emitter terminal of the transistor Q1 is connected to the ground. Further, a resistor R8 is interposed between the base terminal and the emitter terminal of the transistor Q1.

The collector terminal of the transistor Q1 is connected to the power supply terminal Vcc through a resistor R6, and the gate terminal of the logic element 20 is connected to a connection node between the collector terminal of the transistor Q1 and the resistor R6.

Next, the operating process of the protection circuit for the convertible tablet computer according to the present invention, having the above construction, is described below.

First, the operating process of respective elements is described before the description of the operation of the present invention.

As shown in FIGS. 3 and 4, the logic element 20 is in an enabled state, in which operation is activated, when a high level signal is applied to the gate terminal thereof. Therefore, when the high level signal is applied to a gate terminal OE, an input signal, which is input from an input terminal A<sub>IN</sub> is output. That is, if an input signal is a high level signal while a high level signal is applied to the gate terminal, a high level signal is output, whereas if an input signal is a low level signal, a low level signal is output.

The switch SW11 is a switch that is turned on when the LCD panel is closed, and the switch SW12 is a switch for rotating the LCD panel when the computer is operated in a tablet mode. That is, the switch SW12 is turned on in the tablet mode.

Next, an operating process performed when the computer of the present invention is operated as a typical notebook computer is described.

When the computer is operated as a typical notebook computer, the switch SW12 is not operated. Therefore, the switch SW12 is in an Off state, and a high level signal is

applied to the base terminal of the transistor Q1, constructed to operate in conjunction with the operation of the switch SW12, and thus the transistor Q1 is maintained in its turned-off state. When the transistor Q1 is in a turned-off state, the output voltage of the power supply terminal Vcc is applied to the gate terminal of the logic element 20 as a high level signal, and thus the logic element 20 is controlled so that it is in an enabled state.

When the user closes the LCD panel in this state, the switch SW11 switches to an On operation state. Further, the power from the power supply terminal Vcc flows to the ground through the switch SW11, and thus a low level signal is input to the input terminals of the AND gate 15 and the logic element 20. The logic element 20 outputs a low level signal, and a signal, indicating that the LCD panel is closed, is output to the control unit (not shown) in response to the low level signal.

The control unit, which has received the signal indicating that the LCD panel is closed, performs a preset control operation, that is, an operation of causing the system to enter a suspend mode and/or an operation of turning off the backlight of the LCD panel.

Next, if the user opens the LCD panel when the logic element 20 is in an enabled state, the switch SW11 switches to an Off operation state. Therefore, the power from the power supply terminal Vcc is applied to the input terminals of the AND gate 15 and the logic element 20, and the input signal at this time is a high level signal. The logic element 20 outputs a high level signal, and a signal, indicating that the LCD panel is opened, is output to the control unit on the basis of the high level signal. The control unit, which has received the signal indicating that the LCD panel is opened, performs a preset control

operation.

Next, an operating process performed when the computer of the present invention is operated as a tablet computer is described.

5        When the user desires to use the system as a tablet computer, the user uses the display panel as a notepad by rotating the LCD panel. The switch SW12 switches to an On operation state in the tablet mode, and the signal from the power supply terminal Vcc flows to the ground through the  
10 resistor R5 and the switch SW12. The signal obtained from the On operation of the switch SW12 is output through the output terminal 25, thus allowing the system control unit to perform an operation of preparing to enter the tablet mode.

15        At this time, a low level signal is applied to the base terminal of the transistor Q1, and the transistor Q1 switches to a turned-on state. When the transistor Q1 switches to a turned-on state, the signal from the power supply terminal Vcc flows to the ground through the  
20 resistor R6 and the collector terminal and the emitter terminal of the transistor Q1. In conjunction with this operation, a low level signal is applied to the gate terminal of the logic element 20, and thus the logic element 20 is in a disabled state.

25        When the logic element 20 is in a disabled state, as described above, the logic element 20 is maintained in a state in which no signal is output therefrom, even if a signal is output from the switch SW11 for detecting the closing/opening of the LCD panel. Therefore, the control  
30 unit does not perform a control operation based on the output signal of the logic element 20 (operations of causing the system to enter a suspend mode and turning off the backlight of the LCD panel).

As described above, the protection circuit for the convertible tablet computer according to the present invention is characterized in that it prevents erroneous operation from occurring in the system due to the operation of the switch for detecting the closing/opening of the LCD panel when the computer is used as a typical computer or in a tablet mode. For this operation, in the present invention, a simple logic circuit is implemented, and erroneous operation is prevented without requiring the operation of a separate mechanical device.

Through the above description, those skilled in the art will appreciate that various modifications and changes are possible, without departing from the scope and spirit of the invention as disclosed in the accompanying claims. Therefore, the technical scope of the present invention should be defined by the accompanying claims, without being limited to the detailed description of the present specification.

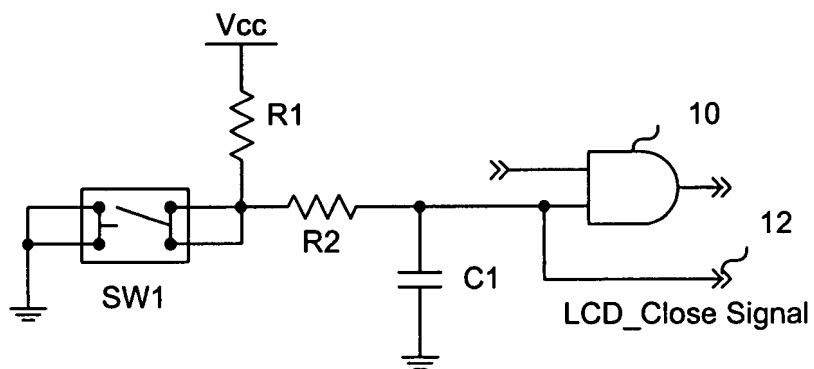
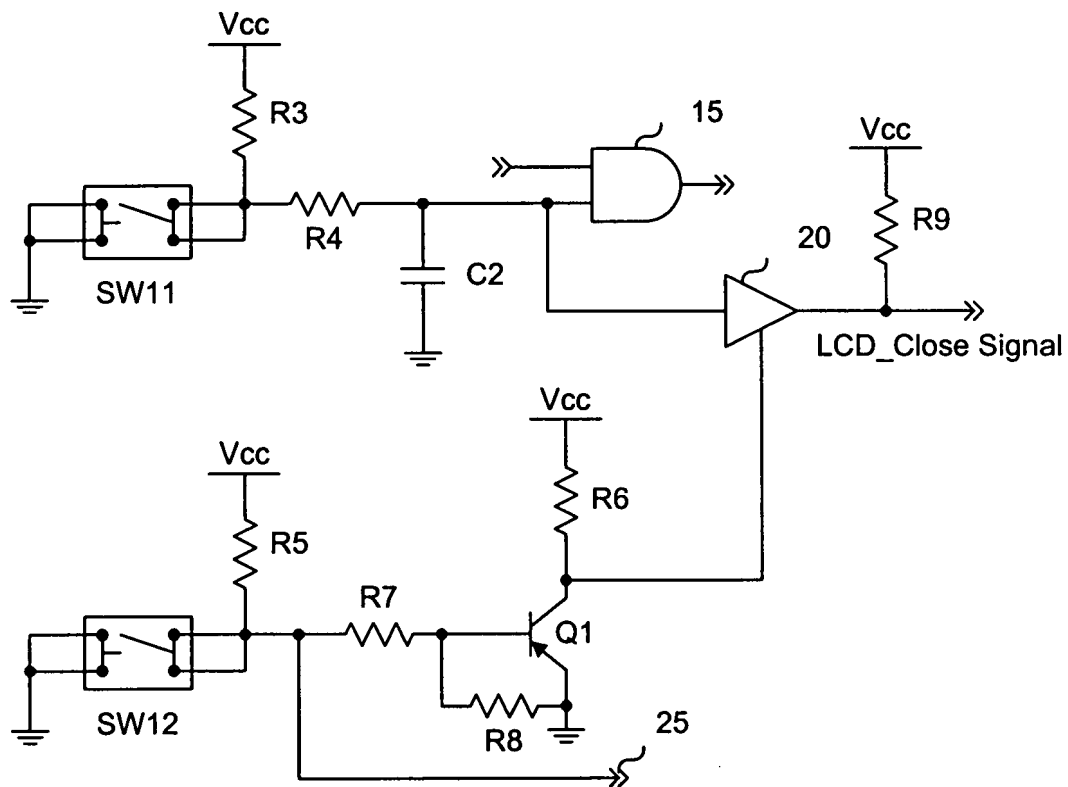
## **Effect Of The Invention**

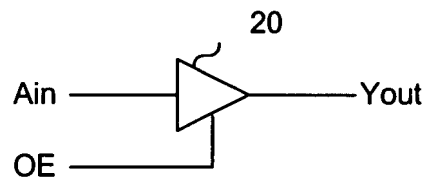
The above-described protection circuit for the convertible tablet computer according to the present invention can prevent the erroneous operation of a system, which may occur when a switch for detecting the closing/opening of an LCD panel is controlled so that it enters a closed state in a tablet mode, in a product in which a typical notebook computer and a tablet computer are implemented together. In particular, the present invention is advantageous in that it is implemented to prevent the occurrence of the erroneous operation of the system using a simple logic circuit, without requiring a separate mechanical device, thus guaranteeing the reliability of products and reducing the manufacturing costs thereof.

**What is claimed is:**

1. A protection circuit for a convertible tablet computer, comprising:
  - a first switch for detecting opening and closing operations of a Liquid Crystal Display (LCD) panel;
  - a second switch for detecting rotating operation of the LCD panel in a tablet mode;
  - a logic element for outputting an opening/closing signal for the LCD panel in response to an On/Off operation signal of the first switch; and
  - a logic element control unit for controlling the logic element so that it is in an enabled or disabled state in response to an operation of the second switch.
2. The protection circuit according to claim 1, wherein the logic element control unit comprises a transistor for switching supply of a high level signal to a gate terminal of the logic element in response to the operation of the second switch.



**FIG. 1****FIG. 2**

**FIG. 3****FIG. 4**

Input		Output
OE	Ain	Yout
H	L	L
H	H	H
L	X	Z